MORPHOFUNCTIONAL CHANGES IN THE THYROID GLAND UNDER TRACE ELEMENT DEFICIENCY

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Abstract: *The study evaluates morphological and microcirculatory changes in the thyroid gland under microelement deficiency (Mg, Fe, Se, Zn) in rats. Deficiency led to reduced gland mass, impaired microcirculation, decreased epithelial height, follicular remodeling, and increased stromal component. The most pronounced alterations were observed under combined deficiency, indicating progressive structural and functional impairment of the thyroid gland.*

Keywords: *thyroid gland, microelement deficiency, morphometry, microcirculation, apoptosis, CD95, CD163, macrophages, thyrocytes, fibrosis*

Aim of the study. The aim of this study was to investigate morphological, morphometric, and microcirculatory changes in the thyroid gland under conditions of microelement deficiency (Mg, Fe, Se, Zn) in white outbred rats.

Materials and Methods. The study was conducted on thyroid tissue samples obtained from 6-month-old white outbred rats divided into two groups: control group (intact animals), experimental groups with deficiency of individual microelements (Mg, Fe, Se, Zn) and combined microelement deficiency.

Morphological and morphometric analyses were performed to evaluate structural changes in the thyroid gland. The following parameters were assessed: thyroid gland mass, capsule thickness, capillary density, capillary diameter, total capillary cross-sectional area, relative vascular area, follicular diameter, follicular area, epithelial height, and stromal component. Microcirculatory characteristics were evaluated separately in central and peripheral regions of the gland.

Quantitative analysis was performed using digital morphometry with measurements expressed in relative and absolute values. Comparative analysis between groups was carried out to determine the degree of structural and functional alterations associated with different types of microelement deficiency.

Statistical analysis included calculation of relative changes compared to the control group, allowing assessment of the severity and progression of morphological alterations.

Results of the study. Thyroid gland mass decreased by 1.09× (Mg), 1.14× (Fe), 1.20× (Zn), and 1.14× (combined), while it increased by 1.04× in Se deficiency, indicating structural remodeling with relatively stable gland size.

Capsule thickness increased by 1.18× (Mg), 1.27× (Fe), 1.34× (Se), 1.15× (Zn), and 1.49× (combined), reflecting prolonged pathological and adaptive changes.Capillary density decreased by 1.25–1.61× (central) and 1.21–1.57× (peripheral), and total capillary area decreased by 1.27–1.66× (central) and 1.24–1.62× (peripheral), indicating microcirculatory impairment.

Capillary diameter decreased by 1.14–1.54× and relative vascular area by 1.15–1.58×, reflecting narrowing of microvessels and impaired blood supply. Thyroid epithelial height decreased by 1.12–1.49× (central) and 1.06–1.27× (peripheral), indicating reduced secretory activity.Follicular diameter decreased by 1.07–1.32× (central) but increased by 1.09–1.37× (peripheral), while follicular area decreased by 1.13–1.52× (central) and increased by 1.15–1.59× (peripheral), indicating colloid accumulation and dystrophic changes.

Stromal area increased by 1.19–1.68× (central) and 1.17–1.63× (peripheral), indicating fibrosis progression. In combined deficiency, epithelial and colloid fractions decreased by 1.42× and 1.43×, while stroma increased by 2.06× (central); peripherally, epithelium decreased by 1.43× and colloid increased by 1.29×.

Follicular distribution changed: large follicles decreased by 1.76× (central) and increased by 1.45× (peripheral), while small follicles increased by 1.65× (central) and decreased by 1.60× (peripheral).

OD index showed decreased central and increased peripheral colloid accumulation, most pronounced under combined deficiency.The most severe changes were observed in combined deficiency, with maximal structural and microcirculatory impairment.

Overall severity increased in the sequence: Zn → Se → Mg → Fe → combined deficiency.